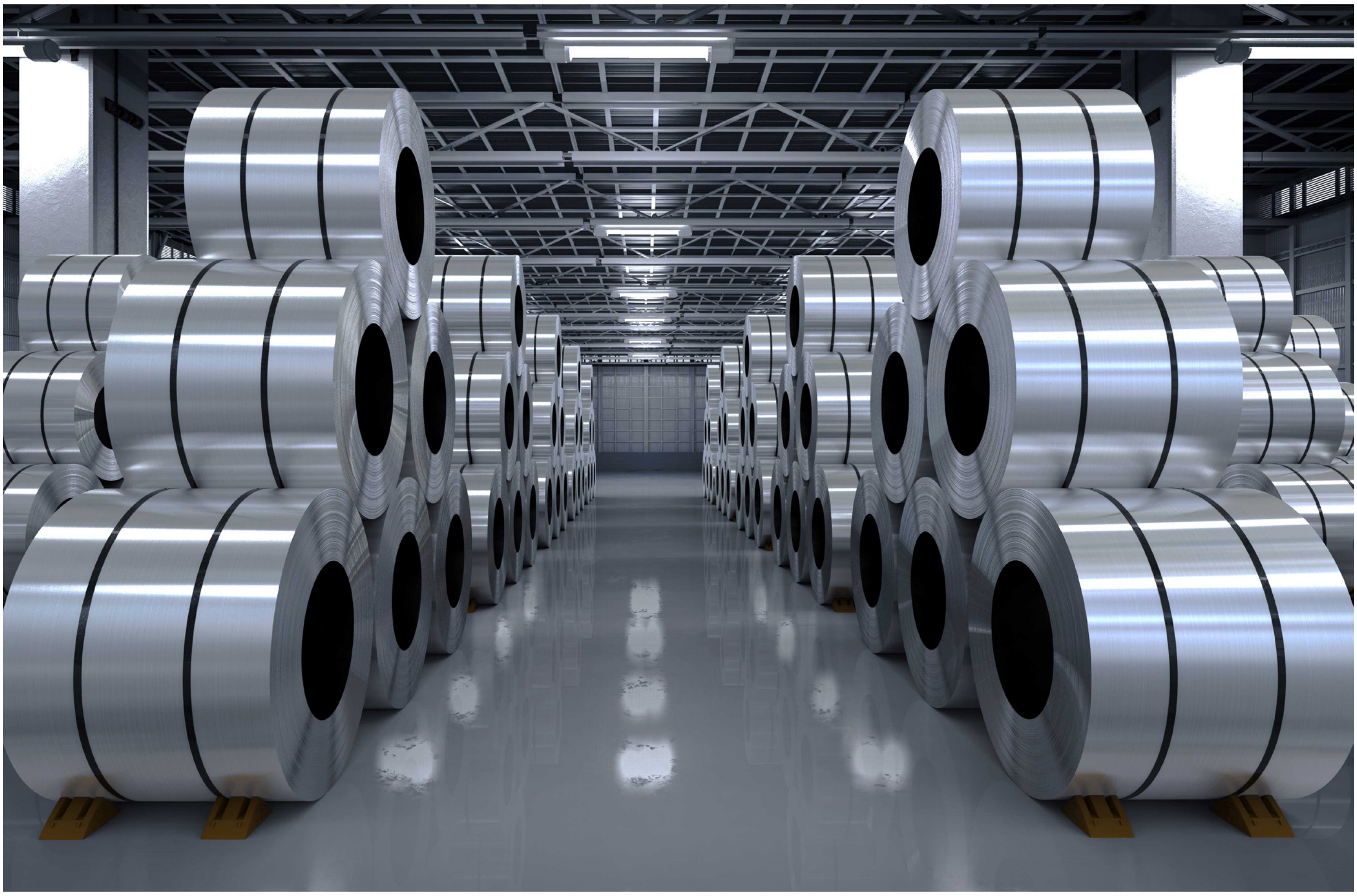


Cold-Rolled Steel Blues — An EMC Case Study

It might seem unlikely, but sheet steel can present a significant concern for Electromagnetic Compatibility (EMC). Al Walker, Founder & CEO of Inline Audio, looks at why it is a hidden risk for EMC compliance and the positive steps that you can take to avoid such situations occurring.

"We've also seen situations where product prototypes taken for EMC testing passed successfully, but subsequent production samples failed.

The only difference was the specification of the surface treatment coating layer on the zinc-passivated SECC steel used for the metal case.

Finding out such issues in mass production is potentially very costly in terms of scrap and rework, and exposes a business to both financial and legal risk..."

Carbon steel sheet is widely used for the metal case components of electronic products, and as it is prone to rust, a zinc or zinc-alloy passivation layer is applied to protect its surface. Additional surface coatings are usually applied to suit different applications and end uses.

You might remember from your school science lessons that many physical properties are analogous, metals are not just good conductors of electricity but also good conductors of heat as well. And the opposite is also true, a plastic material makes for both a good electrical and thermal insulator.

Likewise, a chemically reactive metal is also a good conductor due to the free flow of electrical charge, but the surface treatment coating intended to protect against the chemical oxidising reaction that affects both the base steel and zinc passivation may not necessarily provide the same level of electrical conductivity.

This is a key consideration for EMC compliance, where a case design may rely on surface contact between its component parts to ensure a low impedance electrical bond, in addition to screws and other mechanical fixings.

By low impedance bond, we're talking about electrical resistance in fractions of an ohm. Any decent digital multimeter will be able to display to an accuracy of 0.1 ohm, and that's good enough for an indicative reading.

Check the resistance of the test leads by touching together the probe tips to confirm that they will not affect the reading being made. It's also essential to only lightly press on the surface with the probes when making a resistance reading, preferably with the sides of the probes rather than the tips.

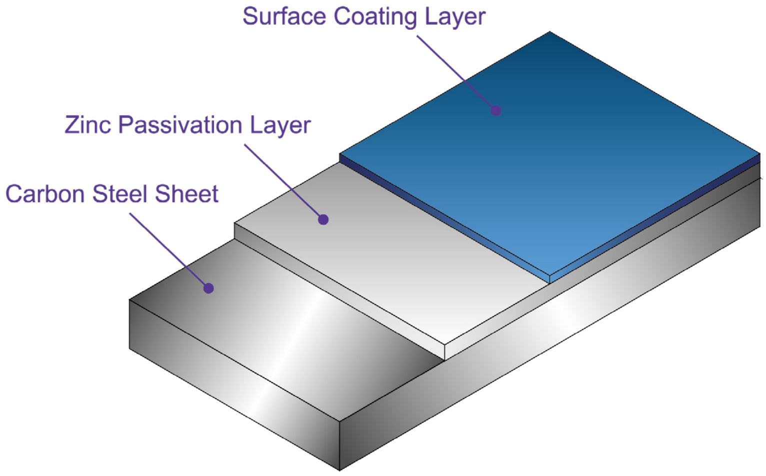


Figure 1: Composition of SECC Steel Sheet

If you have to pierce the surface coating layer (see Figure 1) to get a low resistance reading, it isn't conductive, and you have a potential EMC risk.

This method of getting a surface resistance reading is a qualitative indication, and later in this article we will see how more accurate measurements can be made, and how they compare with the results gained from using a multimeter.

We're all familiar with aerials as being long thin, sometimes telescopic, metal rods that point up in the air. Such aerials are called Monopoles, as they radiate (or receive) from one end only, with the other end being the aerial feed connection.

The length of a Monopole aerial is a quarter wavelength of the fundamental resonant frequency of the aerial.

A Dipole aerial is formed by joining two Monopoles together with a common feed connection in the middle, and so it follows that its length is a half wavelength of the fundamental resonant frequency.

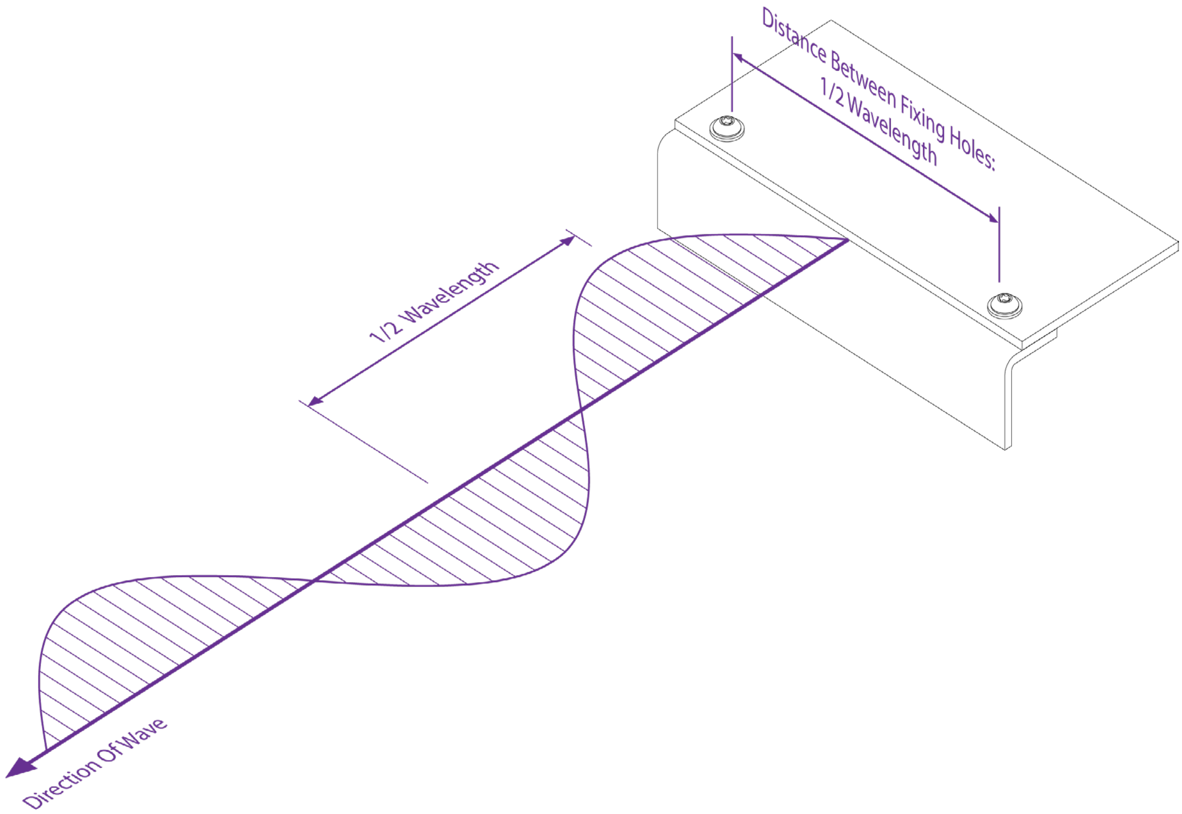


Figure 2: Physical Relationship between Slot Aerial Width and Fundamental Resonant Frequency

As shown in Figure 2, a slot aerial can be formed between two fixing points, with the length between them (as with the length of a conventional aerial) being resonant at a particular frequency, and related harmonics, as a function of wavelength in the electromagnetic spectrum.

So if the mating surfaces do not make consistent electrical contact along their length, then it's very likely that a slot aerial will be created.

Babinet's principle shows us that the radiated field from a slot aerial will have the same pattern as that of a solid Dipole aerial of the same dimensions.

As an example, let's consider two pieces of sheet steel joined by two M3 fixing screws on 80.0 mm centres (we'll ignore the rest of the design for the sake of simplicity).

Allowing for the thread diameters gives us a slot aerial width of 77.0 mm, for a wavelength of 0.154 m.

Going back to our school science lessons, we can use a familiar physics equation for determining the slot aerial's fundamental resonant frequency (f), based on the wavelength (λ) and the velocity (υ) of the emitted wave:

$$\upsilon = f \,.\, \lambda$$

If we divide the velocity of light (3×10^8 m/s) by the wavelength (0.154 m), we get a fundamental resonant frequency of 1.95 GHz (plus multiples as harmonics).

For unintentional radiators (products that for EMC testing purposes are not specifically designed to be transmitters of radio waves), this fundamental resonant frequency is sufficiently high that it is unlikely to pose a concern for EMC testing for many products.

However, if the two screws were further apart, as is common on many products, then the resonant frequency will scale in inverse proportion.

With the screws on fixing centres of 240.0 mm the fundamental resonance will be at 633 MHz, well within scope for radiated emissions testing.

Table 1 shows the inverse relationship between the width of the slot aerial created between two M3 fixing screws and its fundamental resonant frequency.

Successful product design is therefore interactive as it requires collaboration between electronic and mechanical design engineers, with the ideal number of fixings and their spacing determined by the highest clock frequencies of the electronic circuits.

We might speculate about how many products on the market were actually designed with this relationship in mind.

The upper frequency limit for radiated emissions testing to European EMC standards is typically 1.0 GHz.

However, with FCC Part 15 testing for the USA, the limit is 1.0 GHz where the maximum clock frequency generated inside the unit is up to 108 MHz, or five times the maximum clock frequency, up to a limit of 40 GHz (whichever limit is greater).

Maximising surface conductivity is therefore essential for good EMC performance, especially as the rising and falling clock edges generate higher frequency emissions than that of the clock period.

It's even more important for the mating surfaces to be conductive if the fixing centres are too widely spaced to prevent the formation of slot aerials with fundamental resonances within the applicable EMC test frequency limits.

Fixing Centres (mm)	Slot Width (mm)	Resonant Frequency
80	77	1.95 GHz
100	97	1.55 GHz
120	117	1.28 GHz
140	137	1.09 GHz
160	157	955 MHz
180	177	847 MHz
200	197	761 MHz
220	217	691 MHz

Table 1: Slot Aerial Width versus Fundamental Resonant Frequency

The solution here is to select an appropriate zinc passivation and surface treatment that provides both the desired rust protection and a high degree of electrical conductivity to minimise impedances between mating surfaces, two properties that are, at first sight, in conflict with each other.

SECC is an acronym for 'Steel, Electro-galvanised, Cold-rolled, Commercial quality', and is widely used for the cases of electronic products.

The term 'Electro-galvanising' is a bit of a misnomer, as it is not the same as conventional zinc galvanising, which involves immersing the base steel part to be plated in a bath of hot molten zinc.

Instead, the base material, a flat carbon steel sheet or strip, is electroplated in a bath containing a solution of zinc and one or more electrolytes, with a zinc anode and the carbon steel acting as the cathode.

This process of electrolytic deposition results in a pure zinc or zinc-iron alloy layer on one or both sides, with additional surface coatings applied according to the end application.

We have seen many mechanical drawings where the material specification is something like '1.0 mm SECC', without any further definition.

In part this is due to the fact that vendors are sometimes unwilling to provide specifications for the raw materials they buy, in the belief that if they do so, their customers will source their parts from elsewhere.

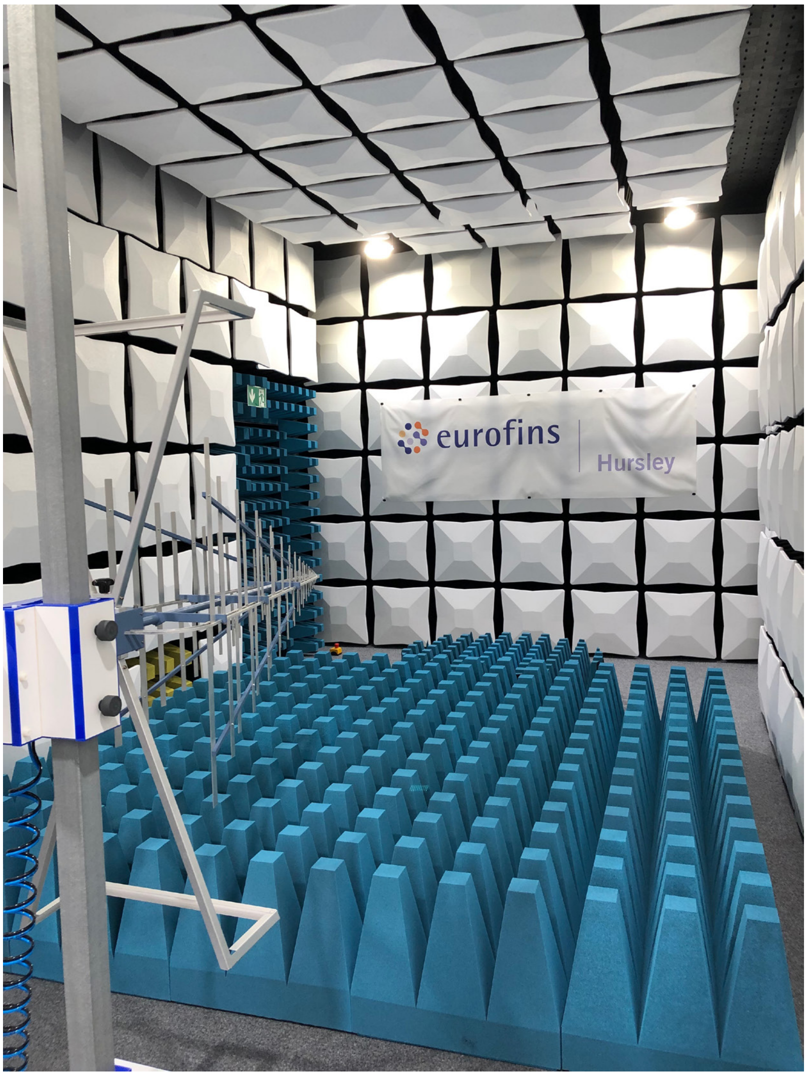
So it's understandable that this very basic level of definition is commonly found on mechanical drawings when design teams are put in a position of having to work in the absence of comprehensive raw material specifications, as they do not always have a say in who their vendors are.

And as a result, we've also seen situations where product prototypes taken for EMC testing passed successfully, but subsequent production samples failed.

The only difference was the specification of the surface coating treatment layer on the zinc-passivated SECC steel used for the metal case.

Finding out such issues in mass production is potentially very costly in terms of scrap and rework, and exposes a business to both financial and legal risk, especially as the discovery may be made by a third party such as a competitor or as part of a market surveillance exercise by a regulatory body or customs agency.

Clearly then, just putting 'SECC' as the material specification on a mechanical drawing is not sufficient to avoid this kind of situation. And there's another issue to consider, fingerprint marks cause zinc passivated surfaces to degrade, resulting in rust patches that match the shape of the fingerprints.



3 Metre Fully Anechoic EMC Test Chamber
(Photo courtesy of Eurofins Hursley)

On a related issue, anyone who has been responsible for taking products for EMC testing will likely had the experience of finding that the sample they've been given has been painted on mating surfaces that were supposed to have been masked off, and had to resort to filing off the paint to get electrical conduction between the mating surfaces to achieve a test pass in order to get an EMC test certificate.

The problem with doing so is that the zinc passivation and surface coating layers will inevitably be removed as well, so the conduction is between the bare steel surfaces.

From a due diligence perspective, filing off paint results in an EMC test sample that is not representative of mass production. The test certificate is therefore not valid as evidence of compliance for mass production, as it does not take into account the surface conductivity of the surface treatment coating when the paint masking instructions are actually followed.

Those newly-filed bright bare steel surfaces might be suitably conductive for the duration of the EMC testing, but without the zinc passivation and surface treatment layers to protect them, they will soon start to rust.

Let's look at some of the national standards covering SECC, to see how they might help us define a specification that meets the twin requirements of rust protection and electrical conductivity.

We will look at the standards for Europe, USA, Japan and China and see how they define SECC steel.

We'll also analyse their shortcomings when it comes to specifying material suitable for the cases of electronic products, as we will find, none offers a complete solution to our requirements.

EUROPE

EN 10152:2017 – Electrolytically zinc coated cold rolled steel flat products for cold forming – Technical delivery conditions

This is a European Standard produced by CEN-CENELEC, so its implementation is not just limited to European Union member countries, European Economic Area and other non-EU countries are also in scope. The standard is available in three official languages – English, French and German.

The English language version is published as a British Standard, the current version being:
BS EN 10152:2017 + Corrigendum July 2018.

It identifies the following surface treatments:

• Phosphated	P
• Phosphated and chemically treated	PC
• Chemically passivated	C
• Phosphated, chemically treated and oiled	PCO
• Chemically passivated and oiled	CO
• Phosphated and oiled	PO
• Oiled	O
• Sealed	S
• As coated, i.e. untreated	U

As we will see in this article, phosphated surface treatments offer very effective corrosion resistance, but as a direct consequence are also non-conductive. Sealed surface treatments are identified as offering protection against corrosion and fingerprints, but no mention is made anywhere in the standard of surface electrical conductivity.

Therefore, this standard ***can't*** be used as a reference by mechanical design engineers for identifying a suitable surface treatment that provides suitable corrosion protection, including against fingerprints, whilst providing a high degree of electrical conductivity.

USA

ASTM A879/A879M — Standard Specification for Steel Sheet Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface

This standard is published by ASTM International, the current version being:

A879/A879M – 12 (Reapproved 2017)

This standard has a much broader definition than the other standards as it covers both hot- and cold-rolled steel sheet. A variety of steel grades are identified, with Commercial Steel (CS) corresponding to the definition of 'Commercial Quality' in the SECC abbreviation.

It allows for both SI (metric) and inch-pound units, but identifies that they are to be regarded separately within the standard, with the letters G and Z being used as a suffix to designate SI units and inch-pound units of pure zinc coating respectively. Whilst the domestic US market will prefer inch-pound units to specify the zinc passivation layer thickness, using SI units allows us to compare the respective national standards.

Some preferred zinc passivation coating thicknesses are given in the standard. It's worth noting that the permitted ranges are significantly wider than those specified in the Japanese JIS G 3313 standard, for example, so equivalence between national standards cannot be assumed.

- Flash Coating 03G 3 - 15 g/m²
- Intermediate Coating 06G 6 - 25 g/m²
- Full Coating 12G 12 - 30 g/m²
- Double Coating 24G 24 - 45 g/m²

The standard also identifies other zinc coating thicknesses, and based on our previous experience of specifying zinc-passivated steel for case designs, we would specify 20G on both sides of the steel sheet, for a minimum zinc passivation coating layer thickness of 20 g/m².

We can start to put together a specification using this standard:

- Name of product: Electrolytic Zinc-Coated Steel Sheet
- ASTM designation and year of issue: ASTM A879/A879M — 12 (Reapproved 2017)
- Base metal type: Cold-Rolled
- Base metal designation: Commercial Steel (CS)
- Formability: No Special Requirement
- Coating designation: 20G/20G (20 - 40 g/m² both sides)
- Surface treatments required: ?

Surface treatments are only briefly mentioned in this standard and there is no associated definition for electrical conductivity:

'Steel sheet is available without surface treatment (dry) or with surface treatments designated as chemical treatment, oiled, or phosphatized. Unless otherwise specified sheet is furnished oiled"

So again, this standard ***can't*** be used by mechanical design engineers to fully specify SECC sheet steel with a suitable surface treatment that provides suitable corrosion protection, including against finger-prints, whilst providing a high degree of electrical conductivity.

JAPAN

JIS G 3313:2015 – Electrolytic zinc-coated steel sheet and strip

The abbreviation JIS stands for Japanese Industrial Standard, produced by the Japanese Standards Association. It has the status of a national standard.

The current version of the standard is **JIS G3313:2015 + Amendment 1:2017**

JIS G 3313: 2015 defines the following symbols for surface coating chemical treatment:

• Chromate treatment	C
• Phosphate treatment	P
• Chromate-free treatment	NC
• Chromate-free phosphate treatment	NP
• Untreated	M

Chromate-free treatment is a chemical treatment excluding hexavalent chromium, which is a restricted substance under RoHS legislation in multiple territories, including the EU and China. If you don't know how toxic and carcinogenic hexavalent chromium is, watch the Julia Roberts biopic about environmental campaigner Erin Brockovich.

Chromate-free phosphate treatment means that the hexavalent chromium-free chemical treatment is applied on the phosphate-treated surface. Again, such treatments should be avoided to ensure that case metalwork surfaces are electrically conductive.

JIS G 3313 uses the phrase Coating Mass to define the thickness of the zinc coating, expressed in grams per square metre (g/m^2), and uses the following terminology:

- Equal Coating: The same coating mass on both sides of the base sheet or strip material
- Differential Coating: Different coating masses on each of the two sides of the material
- One-Side Coating: Coating on one side of the material only

The sequences for expressing the coating mass for sheet and strip base material surfaces are:

- Sheet: Top/Bottom
- Coiled Strip: External/Internal

Previous experience of specifying SECC material for the case components of electronic products is that an Equal Thickness (both sides) pure zinc coating of **E16 E16** (20 g/m^2 Top/Bottom) is recommended.

JIS G 3313 Amendment 1:2017 does not specifically identify Anti-Fingerprint and/or high conductivity chemical treatments, only stating that:

'The symbol of chromate-free treatment shall be agreed between the purchaser and the manufacturer'

This results in a situation where individual manufacturers use their own labelling conventions, as the JIS G 3313 standard ***doesn't*** provide a standardised definition of surface treatment that includes the desired level of corrosion resistance, including anti-fingerprint protection, and high electrical conductivity. We are going to have to look elsewhere...

CHINA

Q/BQB 430-2018 Electro-galvanized steel plates and steel strips

Regardless of where the final assembly of products may take place, the case metalwork, as well as the raw material, for a significant percentage of the world's electronic products is produced in China, and so it is perhaps more appropriate to look for a domestic Chinese standard, especially given the shortcomings of the other national standards when specifying suitable surface treatments to meet our requirements.

Baowu Steel Group is the largest steel producer in China, and the world's second largest steel producer after Luxembourg-based ArcelorMittal. Baoshan Iron and Steel Co. Ltd is one of its subsidiaries, and is responsible for defining the domestic Chinese standard for SECC.

Q/BQB 430-2018 has the status of an Enterprise Standard, which is the Chinese terminology for a commercial, rather than a government, standard.

It defines the following surface treatment coatings:

• Passivation	C5
• Passivation coating oil	CO5
• Phosphate	P
• Phosphate oiled	PO
• Phosphide (containing chromium-free closure)	PC5
• Phosphide (containing chromium-free closure) oiled	PCO5
• Oiled	O
• Uncoated	U
• Chromium-free fingerprint resistant	N5
• Excellent conductivity type chromium-free fingerprint resistant	NE
• Highly corrosion resistant chromium-free fingerprint resistant	NC
• Excellent processing chromium-free fingerprint resistant	NF
• Excellent painting of chromium-free fingerprint resistant	NP
• High-heat-type chromium-free fingerprint resistant	NR
• Tank dedicated chromium-free fingerprint resistant	CSG
• High wear-resistant high lubricity inorganic self-lubricating	SW
• Organic self-lubricating	SL

Surface Treatment **NE** meets our requirements for both electrical conductivity and fingerprint resistance (and therefore the desired corrosion protection), as well as being RoHS-compliant.

So a typical suitable specification for SECC used for the case components of electronic products, based on previous experience, would be as follows:

- **Q/BQB 430-2018**
- **SECC**
- **Surface treatment NE**
- **20/20 (20 g/m² equal thickness pure zinc passivation layer (2.8 µm) both sides)**
- **Material thickness (mm)**
- **Standard temper grade**

This specification still lacks a definition of numerical values for surface conductivity, and in the next section we will look at how precision measurements of the resistance of thin surface films are made.

Four-Point Probe Measurements

Four-point probe meters measure the average resistance of a thin layer or sheet using two separate pairs of electrodes.

Figure 3 shows the arrangement of the probes with an outer pair to create an electrical current flow and an inner pair to measure the voltage drop due to the potential difference arising from the current flow.

They are widely used for measuring the resistance of doping layers on silicon wafers, the resistance of silk-screened carbon inks used for potentiometers and resistors on thick film hybrid circuits, as well as the surface conductivity of SECC and other types of metal.

This method is more accurate than two-point measurements, such as with our digital multimeter, as the separation of the current and voltage electrode pairs eliminates the test lead and surface contact resistances from the measurement.

The two pairs of probes are typically spring-loaded to maintain a constant pressure on the contact area of the sample being measured, to avoid the risk of misleading readings being made due to the probe tips cutting through the surface treatment layer.

Four-point probe meters typically use a unit known as sheet resistance, with units of 'ohms per square' or 'Ω/□', for a square sheet with a thin uniform resistive coating.

A sheet of material measuring 10 ohms per square has an actual resistance of 10 ohm, regardless of the size of the square.

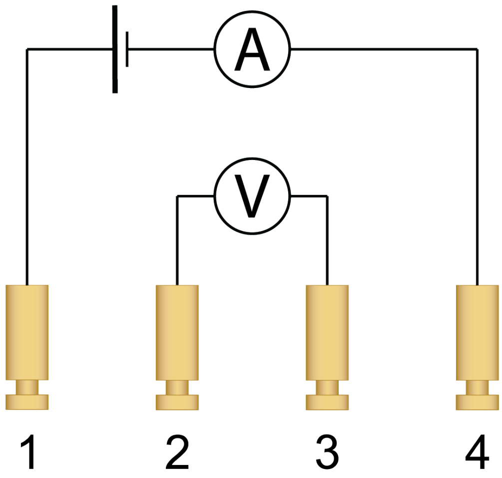


Figure 3: Four-Point Probe Measurement Configuration

The four-point probe meters most widely quoted by steel manufacturers in their sales literature are the Loresta low resistivity meters, manufactured by Mitsubishi Chemical Analytech Co. Ltd.

These meters come in both handheld and desktop versions, the current versions being the Loresta-AX and Loresta-GX.

The latter offers a higher degree of precision and is intended for more critical applications such as measuring the resistance of semiconductor doping layers.

The previous Loresta-EP handheld and Loresta-GP desktop models are also often quoted in steel manufacturers' data sheets.

Loresta-AX Low Resistivity Meter
(Photo courtesy of Mitsubishi Chemical Analytech Co. Ltd.)

Surface Treatment Resistance Testing

We carried out a practical test using a Loresta-AX meter on two sets of SECC metalwork samples, one set having previously failed our basic two-point probe multimeter test, and the second set passing.

We measured five samples from each set with the results shown in Table 2.

The results correlated exactly with our basic multimeter testing, the surface conductivity of the first set being 'OL' or 'Over Limit' and so not conductive (and likely phosphate-coated), whilst the second set measured either zero ohms or fractions of a milliohm (so essentially zero for all practical purposes).

This confirms our experience from measuring multiple sample products that SECC surface treatments are either conductive or they aren't, so it's really a binary outcome with the key determinant being whether a non-conductive phosphate treatment has been used.

Testing with the Loresta-AX meter provided validation for our multimeter measurements, but didn't tell us anything we didn't already know.

The Loresta meters are intended for laboratory testing by qualified engineers and scientists, where measurements in the milliohm and micro-ohm range matter.

In these applications they excel in providing high precision measurements. They are also ideally suited for calibrated production testing by steel manufacturers.

But they are perhaps not so appropriate for semi-skilled staff doing inbound quality control (IQC) inspection of production metalwork, where measurement results need to have a clear and unambiguous pass/fail indication, such as red and green traffic light style LED indicators.

It's only human nature to want to produce good results, and as the sharp ends on multimeter probes can easily pierce the surface treatments on SECC material, it's likely that unsupervised testing with a multimeter will result in false positive readings.

This is especially of concern for on-going EMC compliance when there is pressure from other teams or perhaps financial incentives from vendors to pass incoming material.

We see a commercial opportunity for a four-point probe low-resistance meter that is simple to use and cost-effective (the same order of cost as a Fluke or similar professional level multimeter) that manufacturers can go out and buy in significant numbers.

One that provides more reliable and consistent measurements than a multimeter, but doesn't need to measure down to fractions of a milliohm or offer the comprehensive feature set of the Loresta meters.

But given the binary results we've seen with our surface conductivity measurements, perhaps a pragmatic solution in the meantime for IQC inspection and other similar circumstances where a basic pass or fail is all that is required, would be ball-ended multimeter probes that can't pierce the surface treatment layer of the zinc-passivated SECC material.

As this is a potentially a very low cost approach to confirming the surface conductivity of SECC material, certainly for the purposes of demonstrating continued EMC compliance, we plan to get some ball-ended meter probe samples made and conduct a trial of their effectiveness.

Sample	Sheet Resistance (Ω/☐)	Sample	Sheet Resistance (Ω/☐)
1A	OL	2A	9×10^{-5}
1B	OL	2B	0
1C	OL	2C	0
1D	OL	2D	3×10^{-4}
1E	OL	2E	0

Table 2: Sheet Resistance Measurements using Loresta-AX Meter

Due Diligence

So what other steps can you take to ensure a consistent supply of sheet steel for your production metalwork?

Start by requesting a copy of the mill certificate from the sheet steel vendor via your vendor for each batch of steel used to produce the metalwork components.

Although such certificates often include a column for resistance or conductivity measurements, you might well find that this column is empty, indicating that measurements are not being done as part of quality assurance testing.

We've anonymised the below example of a mill certificate that we received from a Chinese vendor recently, although we didn't have to blank out the resistance column as it wasn't filled in.

You will see that it identifies the JIS G 3313 standard, rather than Q/BQB 430-2018, which perhaps indicates the level of awareness of the latter standard within China.

We've included the E16/E16 (20 g/m² both sides) surface treatment thickness to show where we get our specification from.

In such cases, raise the issue with your vendor, requesting that resistance measurements are performed and recorded on the mill certificates. Ask if steel suppliers have Loresta or similar four-point probe meters, and if not, how can they guarantee consistent values? Ask for documentary evidence.

It's worth noting that Q/BQB 430-2018 doesn't specify limits for electrical conductivity, so as a contingency measure, especially if the steel vendor is not able to provide conductivity or resistance measurements on their mill certificates, take readings of sample material from each production batch as part of your on-going EMC due diligence.

If you don't have access to four-point probe measurement equipment, then readings made with a multimeter will provide a qualitative pass/fail indication.

Alternatively, ask if local test houses such as SGS or Intertek can do sample testing for you instead.

These measurements should be compared with those taken of the reference samples that were used in the EMC tests to ensure consistency of supply.

If you do have four-point probe measurements from your EMC test samples, you can use them as part of the material specifications on your mechanical drawings.

The resistance measurements for EMC reference units should also be documented in each product's Technical Construction File, so that there is an official record that they were made.

MILL TEST CERTIFICATE

PO No :
Order No :
Commodity : Electrolytic Zinc Coated Steel
Supplier :
Spec & Type : JIS G 3313 SECC E16/ E16 (20 / 20)
Customer :
Date Of Issue :
PAGE: 1/1

订单规格 (mm) Order Size (mm)	产品号码 Product No	色度	重量 KGS	炉号 Charge No	硬度 Hardness	弯曲 Bending Test	Resis tance	拉伸试验 Tensile Test			镀锌量 Zn Coating Weight		表面处理 Surface Treatment	化学成分(%) Chemical Composition(%)				
								屈服 YP	抗拉TS	伸长EL	Top	Bot		碳 C	硅 Si	锰 Mn	磷 P	硫 S
					[HRB]		[ohm]	[N/II]	[N/II]	[%]	[g/C]			-3	-2	-2	-3	-3

* Tensile Test
: Direction Longitudinal, Gauge Length 50mm
* Surface Treatment
: P-Phosphated, AFP-Anti Finger Paint(Cr Free AFP)

We Hereby Certify That The Product Described Herein Has Been Satisfactorily Tested In Accordance With The Specification

Chief Of Quality Control Team

Conclusion

It's not an uncommon industry practice to do EMC testing on a prototype or pre-production sample once, and then build many batches of production units over the following years or even decades, using the test certificate from that one time test as evidence of on-going EMC compliance.

Sometimes the test sample and mass production units are even built in separate countries with completely different supply chains. This is often done in the belief that if the bills of materials do not change, then the products being manufactured are identical to the original test sample.

But as we've seen in this article, in the absence of a fully defined specification for the surface treatment coating for zinc-passivated SECC sheet steel, it's likely that variation in the material supplied will occur between production batches.

So it's clearly necessary to carry out EMC testing on a pre-production sample, prior to commencing mass production in a new location, to confirm that the products being built are still compliant. Continuous monitoring of incoming material is also essential as part of on-going due diligence obligations.

Otherwise, a worst-case scenario for a manufacturer would be to find that their entire production, perhaps going back years, is not EMC compliant.

And as we noted earlier, the gap between basic multimeter testing and the sophistication of the Mitsubishi Loresta meters creates a market opportunity for a cost-competitive four-point probe meter that is easy to use and that will help manufacturers meet their EMC due diligence obligations.

The SECC specification that we identified using the Q/BQB430-2018 standard is currently the best that we have to work with, although as a domestic Chinese standard it may not have the same level of recognition elsewhere.

And so given its widespread use in the electronics industry, we would therefore suggest that the national standards for SECC be revised to include the electrical properties of each type of surface treatment.

Identifying the permissible sheet resistance range would allow designers to explicitly define the specification of the SECC material to be used for electronic products in order to meet their EMC compliance obligations.

We hope that this article is useful in highlighting an often overlooked risk for EMC compliance, indeed we've seen that even very knowledgeable design engineers with decades of experience were not aware of this issue, so if it's news to you, please rest assured that you are not alone.

About Inline Audio

www.inline.audio

We are a brand and product launchpad for the professional audio industry. We go beyond existing product categories to create original design concepts with and for those who share our values and commitment to innovation. Those with vision, who take a leadership role and move our industry forward.

We believe that the total cost of ownership, long operating life and high retained value are more important than the price tag. When we design and manufacture products, we are conscious of the fact that we are consuming the planet's resources, and so we want to do so as responsibly as possible.

We share our accumulated knowledge and experience because we want to give back to an industry that has supported our careers. And we would like to help designers, engineers and manufacturers everywhere make the right choices to ensure the best possible product quality and reliability.

As we say, our mission is to find better problems to solve…

We welcome any comments or feedback on this article.

Please contact us at ***info@inline.audio***

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