

## Stronger than snow

Skiers will tell you: snow is not as soft as it looks and ice can hit you hard. So, the equipment that removes many tonnes of snow from the roads and airport runways each winter must be powerful and strong. However, the anticorrosion coatings that find themselves between the metalwork and the snow must be strong too, to remain there as the winter work goes on. And after that, it has to continue protecting the substrate.

Küpper-Weisser of Bräunlingen, Germany, have perfected the art of providing such a high-performance coating. They have been manufacturing snowploughs, grit-spreaders, road sweepers and other such equipment for over two decades and gained from their experience.

The steelwork for their vehicles is hot-dipped galvanised with zinc. This protects against corrosion even at scratches and dents in the paint, where road de-icing salt normally gets in to attack the steel.



A powder coating is then applied to protect the soft zinc and it is important for it to have a strong bond to the zinc. The company regularly uses a Crosshatch adhesion tester (Elcometer 107) to confirm it.

The company use an Elcometer 355 to measure and record the thickness of the coating system on the equipment in their works. When visiting their customers, staff members take the smaller Elcometer 456 gauge with them.

As a result, Küpper-Weisser are confident offering a 12-year warranty on the duplex (coating plus galvanising) protected road-clearing equipment.

More about their activity is at [www.kuepper-weisser.de](http://www.kuepper-weisser.de)

## Marine Inspection Kit

Marine coating inspection uses a fundamental set of gauges as determined by the IMO Performance Standard for Protective Coatings for ballast tanks. Now, you can now buy all of them in one go.



In Elcometer's Marine Inspection Kit, one carrying case houses all the required parts; surface profile gauge, cleanliness standards, dust test, salt meter and climatic tests.

Of course, there is a coating thickness gauge - but one with a difference. It filters measurements using the IMO 90/10 Rule. This insists 90 percent of the readings are above the nominal thickness and that no readings are below 0.9 times the nominal.

You must get one of these kits!

## Over to you, son

For Frank Dük, Director of BAMR, the lure of holidays, relaxing and spending time with his grandsons has finally resulted in his decision to officially retire.

He has been involved in the company since 1961 when he took over from his father, who started the company in 1946. BAMR has represented Elcometer in Southern Africa since 1948 and are the sole distributors for Elcometer's three divisions there.



In the photograph we see Frank (second from left) with his three sons Graham, Rob & Will, who are all BAMR Directors. Graham & Rob have taken over the running and day-to-day business of BAMR though Frank will still be involved.

We wish Frank a happy retirement and good health, and the boys good success in the business!

## product of the month

### Elcometer 3034

Even soft coatings are tested with a hardness tester. A classical method is the Pendulum Tests by Persoz and König in which the coating absorbs energy from a ball rolling on the surface. This causes the swing of the attached pendulum to reduce, compared to testing a hard surface such as glass.

The test is very sensitive so to prevent interference from local air currents, a plastic cabinet is provided to surround the Elcometer 3034, which can perform either test.

For further information on the Elcometer 3034 and the individual 3030 and 3040 testers, or any of the hardness testers available from Elcometer, visit [www.elcometer.com](http://www.elcometer.com) or contact BAMR at [sales@bamr.co.za](mailto:sales@bamr.co.za).



### Keeping the Navy afloat

A ship's ballast tanks help keep its hull stable in the sea but the water in there quickly corrodes any exposed steel. The US Navy found the protection of their tank walls was failing within a couple of years. The anti-corrosive primer and a topcoat of epoxy were expected to last at least seven years.

There are over 2900 ballast tanks in the US Navy and re-preserving these had been costing the fleet about \$75 million annually. It was the most expensive item in their budget. So, what went wrong?



*A ship's ballast tank is corroding after only 3 years in service*

An investigation came up with two key contributors to premature failure. One was the lack of adequate surface preparation prior to coating, both during new build and repair. The second was the inability of the coating system to maintain thickness over sharp corners and welds, compared to that over adjacent flat areas.

So, the original coating system that was solvent-based was replaced by a solvent-free system that stays thick over corners. Due to the high solids content, the coatings do not pull back from a sharp edge while curing and maintain about 70% of the thickness of the nearby flat area. Less solvent in the formula also means less VOC (volatile organic compounds) during painting.

However, even an excellent coating will fail if the substrate is not prepared properly. Procedures were put in place to comply with surface preparation standards (ASTM, NACE, SSPC) as well as the mechanical rounding of sharp edges and welding. Measurement of the salt on the surface was added to confirm washing was removing it, not just spreading it around. Then the ambient conditions were monitored from before coating to after, as a record to confirm humidity was ideal for the job.

The extra monitoring and recording of each stage ensures everything is correct before the next layer is applied. Finally, dry film thicknesses are recorded at the rate of 5 per 100m<sup>2</sup> of surface. When the coating system hardens, only then are the tanks filled with water. The same process is applied to new construction.

The new procedures have already resulted in a noticeable extended protection of the ship's internal tanks from corrosion. The target is a 20-year life, which would mean more time afloat rather than being repaired in the shipyard and a big reduction in cost.

Test equipment that is used for this specification (US Navy PPI 63101-000) includes, profile gauge, pictorial cleanliness standards, dust sampling tape, Bresle patches, humidity meter and coating thickness gauge. All the measurements are collected for future reference.



*A big improvement with the new coating system*

Thanks to [www.nstcenter.com](http://www.nstcenter.com)

### Trendy stylish enamel

Metallic surfaces, special effect colours and reflective finishes have increasingly found their way into product design. With the metallic trend, the demand for stainless steel and copper has caused dramatic increases in metal prices. Designers are looking for more-economical materials such as porcelain-enamel coatings, which have been adapted to give trendy metallic looks but with a substantially lower price tag.

Cost savings per square foot for a typical kitchen range serves as an example. With porcelain-enamel coatings, designers can fabricate from plain steel instead of 300 Series stainless. The coating goes on as a 50 microns ground coat and a 100 microns cover coat. Using general market prices from May 2007, the enamel cuts costs by nearly 60%. The coating also withstands scratches that would relegate many stainless steel parts to the scrap heap.

Porcelain enamels are glassy coating materials. They bond to metals (carbon steel, stainless steel, cast iron or aluminium) at temperatures from 540-870°C. Test samples of enamel have shown its advantages over stainless steel. The ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test covers the hardness of organic paints. This test assesses the force required to gouge a coating with a drawing lead of calibrated hardness. Enamel was off the scale and could not be scratched with the hardest 9H pencil, while a softer 5H pencil did scratch the stainless steel sample.

The ASTM D 4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser evaluates abrasion resistance. Panels experienced 2,000 cycles under the hardest CS-17 wheels with a 1kg load. Technicians measured the weight loss. Stainless steel lost about as much weight as the enamel but was visually scratched and damaged.

Unlike stainless steel, enamel does not show noticeable fingerprints, does not discolour from heat and is resistant to stains, scratching and chemical cleaners. Modern colour and metal combinations are helping this traditional coating continue to be specified for stylish domestic appliances and cooking pans.

Measuring the thickness of enamel can be done with an Elcometer 456FNF when the metal substrate has cooled.

Thanks to Ferro Corp. Ohio

### Product awareness training

Are you or your colleagues involved in distributing Elcometer products? Do you need to improve your knowledge of the many products in Elcometer's catalogue? Then register your place now.

Those involved in distributing and selling Elcometer's products can update their knowledge in April. The next product-awareness training programme will run in Manchester from Monday 7th April to Thursday 10th April 2008.



Don't leave it too late. To reserve your place, contact me now: [steve@elcometer.com](mailto:steve@elcometer.com).

## New Elcometer 331<sup>2</sup> Half-cell Meter

To survey an existing concrete structure for rebar corrosion, you only need a Half-cell meter and probe. Such an instrument is now available as part of the Elcometer 331 series.

The new Elcometer 331<sup>2</sup> Half-Cell Meter is available in two models. Both provide a quick assessment of the condition of rebars and steel structures within concrete by measuring the corrosion potential (voltage) at the surface.



To test concrete contaminated with salt, such as that near the sea, plug in a Silver probe. Otherwise, use a Copper one. Connect the return lead to some exposed rebar to complete the circuit. Then wet the surface of the concrete and simply place the end of the probe on it.

By working in a methodical way, according to a line or grid of squares, a structure can be mapped. The HM model has data-logging capabilities and can store up to 240,000 Half-Cell voltage readings in either linear batches or grid batches.

A map of the survey is particularly useful in a report to show the extent of the corrosion, probable and actual. Such a report is produced by CoverMaster® software, which is included with each HM-type gauge. Data uploaded from the memory can appear in a standard report or in one you design yourself. Tools are provided to quickly create detailed, professional reports.

The other version of the Elcometer 331<sup>2</sup> is Model H, a basic, entry-level gauge. Yet, it has the same illuminated display, four-key selection and intuitive menu in several languages. Both can be used straight from the box.

Note that the Model H and Model HM only measure the corrosion voltage. If you need to measure the thickness of concrete covering the rebars, use one of the Elcometer 331<sup>2</sup>B Covermeters or choose the Elcometer 331<sup>2</sup>BH with both the cover and the corrosion potential functions.

For more information about these instruments, visit [www.elcometer.com](http://www.elcometer.com) and select the **Concrete and Civil Engineering** section.

### **STRUCTURAL FAULTS & REPAIR-2008**

*12<sup>th</sup> International Conference + Exhibition*

Innovation in investigation and repair of  
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**10th - 12th June 2008**

Edinburgh, Scotland

## ISO 25178

**Geometric product specifications - Surface texture: areal**

A measure of some property of a surface is called an 'areal' parameter. Similar to the measurement of a rough surface as the variations along a straight line, areal measurements are variations over an area. This three-dimensional (3D) representation is obviously closer to real life but the definitions and mathematics are only just being standardised. The new standard ISO 25178 is at the start of this process.

Running parallel to this are other projects to make the measurements in a repeatable way. Friction and abrasion resistance of nearly smooth surfaces are very important in many industries. But even blast cleaning and painting could use 3D measurement parameters to describe them more effectively.

At present, ISO 8503-1 (Elcometer 125) is a physical representation of standard profiled surfaces. However, many people prefer to work with numbers. Even if they don't understand the calculation of that number, with it they can judge more easily. Testing with Testex Tape (Elcometer 122 with 124) provides such a number and its value is similar to the new 3D parameter Sz, which defines the maximum peak-to-valley height of the profile in an area.

Another new parameter is Sq, the root mean square height distribution of peaks (or depth of valleys) in the area. This measures consistency and is similar to the Standard Deviation calculated by the Elcometer 224 Digital Profile Gauge.

Many inspectors would agree that an ideal measurement system for use on site would be something placed on the surface that gives the result of a group of readings in one go, leading to a quick decision. It looks like this wish may become reality in the near future, using optical technology. Taylor-Hobson's CCI 3000 does it now but it's not the size and price we want.

So, for now, we will have to continue using the existing linear gauges and physical replicas to collect our data and to generate test records.

## Pipeline standard

The existence in the international petroleum and natural gas sectors of different standards for pipeline coatings has posed problems for suppliers, manufacturers and end users. A solution is now available, ISO 21809-2:2007, Petroleum and natural gas industries – External coatings for buried or submerged pipelines used in pipeline transportation systems - Part 2: Fusion-bonded epoxy coatings, which provides in a single document a consistent and unified approach to requirements worldwide. A part of it is a specification for inspection and coating thickness.

## Top one in top five

The best selling ASTM standard for coatings is the fifth most popular of all the ASTMs. It is "Standard Test Methods for Measuring Adhesion by Tape Test", ASTM D 3359. This and others are available from your local standards house or from the Internet at [ansi.org](http://ansi.org).

## applications: industrial coatings

In this series of articles, we look at specific applications, answer some of the most commonly asked questions and provide practical advice. This month, we look at industrial coatings applied indoors.



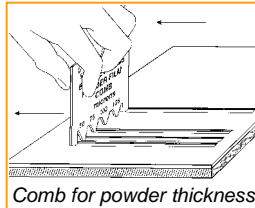
Solvent-free coatings and solvent-based coatings

Most films can be put into one of two main groups: those formed after evaporation of a solvent and those formed after an input of energy. Although the two types of film have some useful differences, they also have many properties in common, especially when cured. This means they can be tested the same way.

Coatings are selected at the design stage of a product, based on their characteristics as determined by the lab of the paint company. In production, some of the lab tests must be repeated, to confirm the film is ready for its career of protection and decoration.

### THICKNESS AS APPLIED

The final thickness of a powder coating can be determined before heat is applied to cure it. This allows adjustments to the process without generating scrap. A gauge such as Elcometer 155 Powder Film Comb can measure the sprayed on powder before the items go to the oven. Large-volume work is better tested with the Elcometer 550 Ultrasonic gauge, which leaves no marks and displays the final cured thickness. Both gauges can be used in accordance with ASTM D7378.



Comb for powder thickness

For UV-cured coatings and liquid paints, we use Wet Film Combs such as the Elcometer 112. Although these are similar to the Powder Comb, in use they are pressed into the coating rather than pulled along the substrate.

### HARDNESS

The paint lab technicians will have used a Clemen tester (Elcometer 3000) to determine the final hardness of a finish. As curing and hardening is mainly a function of energy and time, either of which could vary on the production line, a simpler gauge (the Elcometer 3092 Sclerometer) will determine if the coating is still soft inside. Another method is pushing pencils of different hardness (Elcometer 501) along the surface in a controlled way.



Clemen test in progress

### FLEXIBILITY

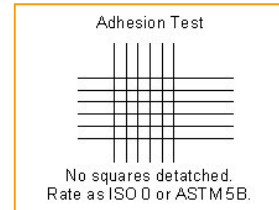
When flat, coated sheet (or coil) is bent to shape, the coating must bend with it and remain connected to the substrate. What actually happens is the convex surface is stretched more as the radius is reduced. Cylindrical (Elcometer 1500) or conical (Elcometer 1510) mandrels are mainly used in the lab to see up to which point a particular formulation of the coating resists bending, rather than testing samples from the production line.

### IMPACT RESISTANCE

Powder coatings can become over-hard if cured too quickly or at too high a high temperature. A severe knock can then cause this brittle coating to shatter, overcoming the adhesive bond. A test for this is to drop a rounded weight from a controlled height (Elcometer 1720) onto the sample, to see if the coating bends or breaks from the energy being suddenly applied.

### ADHESION

Modern coatings are very good at forming strong continuous films but we must be sure they actually stick to the substrate. Degreasing and pre-treatment usually precede coating and if these are not done well, the finish will simply sit there. The best way to be sure is by cutting the coating into small squares according to the Crosshatch test (Elcometer 107). If any of the corners break or if the squares come off, this shows how bad the adhesion is, rather than how good. This test, combined with a falling weight test, is useful for coil or sheet coatings.



### CURED THICKNESS

Thickness of the coating is measured with gauges described in previous articles in Elconews, such as the Elcometer 456.

### GLOSS

An important attribute of a manufactured item is its appearance. A part of this is how well it shines or reflects the light. For office furniture, it is more important how little it reflects light. Either way, the property is the same: gloss.

A variation in gloss also appears to our eyes to be a change in shade, even when the same coating is applied. This could be because of over baking or not enough time in the oven. Eyes will see the difference, especially when two extreme samples are placed side by side. But eyes and opinions vary so, for an independent consistent measurement, we use a glossmeter (Elcometer 407).



Glossmeter with statistics

### PINHOLES

A strong continuous coating can provide good anti-corrosion. But checking a large area of it for any tiny holes needs the help of a detector such as the Elcometer 270. The water in its sponge will complete the circuit to the substrate only through a pinhole. No pinhole, no corrosion.

Should you require any further information on testing industrial coatings or if there is a subject you would like to see mentioned in Elconews e-zine, please e-mail us at: [editor@elcometer.com](mailto:editor@elcometer.com)