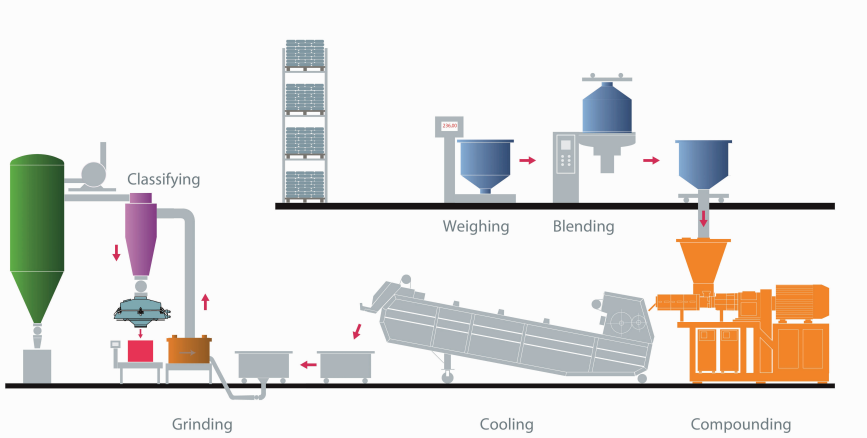
5 Production & Quality

production process



Powder coatings are based on polymer resin systems, combined with hardeners, pigments, fillers, and additives.
production of powder coatings.
- Pre-weighing (premixing) - this involves the weighing and mixing of all the raw materials in the formulation.
- Extrusion - this involves the powder being heated up, which melt the resin and hardeners. The consistency of the powder changes to a viscous form.
- Cooling - it's cooled, which hardens the mixture and turns it into a sheet at cooling belt. This sheet is then breaked down into small chips.
- Micronising - the big powder chips are then fed into a grinding machine, which grinds the chips down into a fine powder. This powder is then sieved to make sure no large particles contaminate the powder.

quality control

The Quality Control Department at Element has many responsibilities, with quality of the end product being the main objective. This task, however, is not a simple one, because it entails a number of checks before we can offer the product for sale.

Each person involved in making a product is responsible for making it a quality product. The Quality Departments exist as an audit function within the manufacturing area. The responsibilities for QC are as follows:

1. Approve or reject all procedures, specifications, methods, and results.
2. Approve or reject all raw materials, packaging materials, labeling and finished products.
3. Review all production records for accuracy and completeness before approving for distribution.
4. Establish procedures for revising procedures, formulas, etc.
5. Approve changes to procedures, formulas, etc.
6.Ensure that the latest revision is being used at all times.
7. Perform all the required tests to ensure quality

Manufacturing plant produce hundreds or thousands kg of powder coatings daily. Due to volume, QC cannot inspect every kg of every product made. This is where scientific sampling comes into play. It is important to have trained individuals in each step of the process. Producing quality products is a team effort requiring the support of the line operators, cleaning and manufacturing/packaging management. As you can see, from start to finish, Element Quality Control Department works to maintain the highest possible standards so that you can be sure that the product that reaches the warehouse is something you can rely on.

quality assurance system

Our Quality assurance (QA) system refers to the planned and systematic activities implemented in a quality system so that quality requirements for a product or service will be fulfilled. It is the systematic measurement, comparison with a standard, monitoring of processes and an associated feedback loop that confers error prevention. This can be contrasted with quality control, which is focused on process outputs. **"Element gained accreditation of ISO 9001:2000 in 2008 by"** All employees are involved in achieving our Quality Assurance program which meet all aspects of the customer satisfaction.

powder coating testing methods

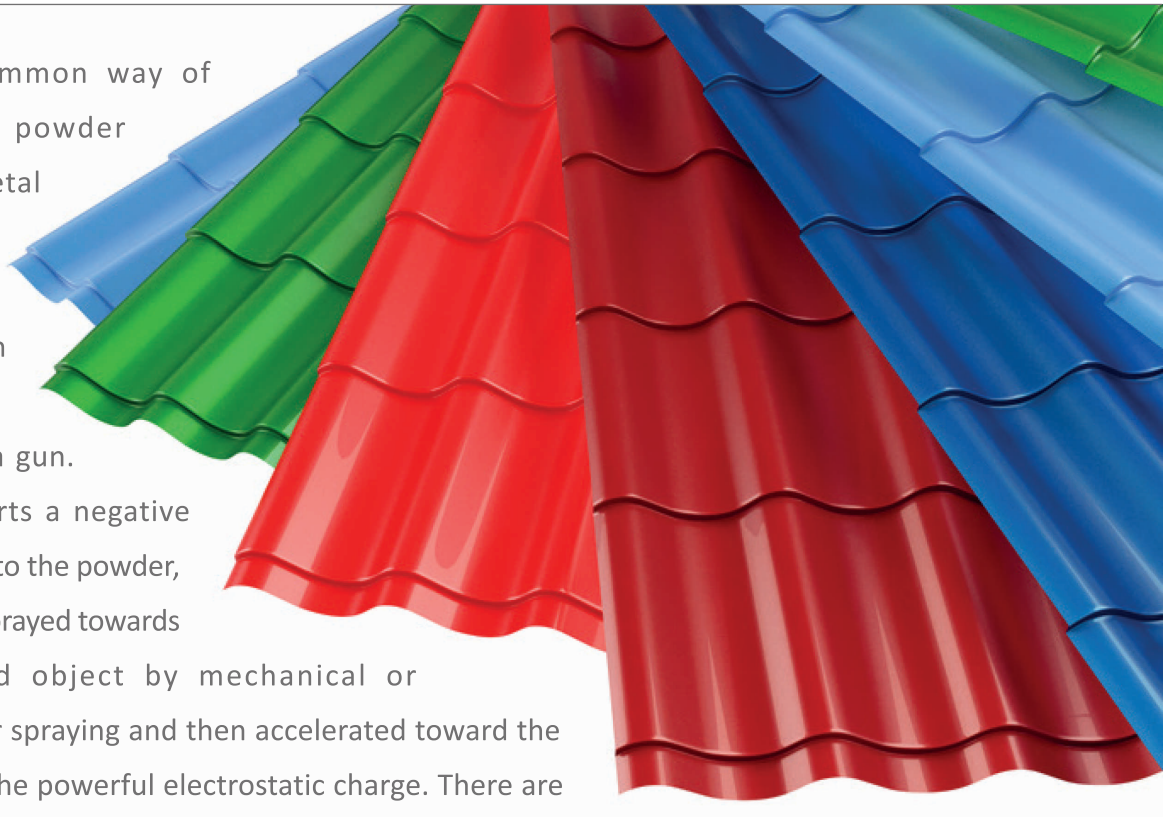
ASTM Standards for Coatings

* B117 Practice for Operating Salt Spray (Fog) Apparatus
* D522 Test Methods for Mandrel Bend Test of Attached Organic Coatings
* D523 Test Method for Specular Gloss
* D609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products
* D870 Practice for Testing Water Resistance of Coatings Using Water Immersion
* D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
* D1308 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
* D1474 Test Methods for Indentation Hardness of Organic Coatings
* D1654 Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
* D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials
* D1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting
* D1731 Practices for Preparation of Hot-Dip Aluminum Surfaces for Painting
* D1732 Practices for Preparation of Magnesium Alloy Surfaces for Painting

* D1735 Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
* D1737 Method of Test for Elongation of Attached Organic Coatings with Cylindrical Mandrel Apparatus
* D2092 Guide for Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting
* D2201 Practice for Preparation of Zinc-Coated and Zinc-Alloy-Coated Steel Panels for Testing Paint and Related Coating Products
* D2244 Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
* D2247 Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity
* D2248 Practice for Detergent Resistance of Organic Finishes
* D2369 Test Method for Volatile Content of Coatings
* D2454 Practice for Determining the Effect of Overbaking on Organic Coatings
* D2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
* D2803 Guide for Testing Filiform Corrosion Resistance of Organic Coatings on Metal
* D2967 Test Method for Corner Coverage of Powder Coatings
* D3260 Test Method for Acid and Mortar Resistance of Factory-Applied Clear Coatings on Extruded Aluminum Products
* D3359 Test Methods for Measuring Adhesion by Tape Test
* D3363 Test Method for Film Hardness by Pencil Test
* D3960 Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
* D4017 Test Method for Water in Paints and Paint Materials by Karl Fischer Method
* D4039 Standard Test Method for Reflection Haze of High Gloss Surfaces
* D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
* D4086 Practice for Visual Evaluation of Metamerism
* D4145 Test Method for Coating Flexibility of Prepainted Sheet
* D4214 Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
* D4217 Test Method for Gel Time of Thermosetting Coating Powder
* D4242 Test Method for Inclined Plate Flow for Thermosetting Coating Powders
* D4585 Practice for Testing Water Resistance of Coatings Using Controlled Condensation
* D4587 Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
* D5031 Practice for Enclosed Carbon-Arc Exposure Tests of Paint and Related Coatings
* D5382 Guide to Evaluation of Optical Properties of Powder Coatings
* D5767 Test Methods for Instrumental Measurement of Distinctness-of-Image Gloss of Coating Surfaces
* D5861 Guide for Significance of Particle Size Measurements of Coating Powders
* D5965 Test Methods for Specific Gravity of Coating Powders
* D6132 Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Gage
* D6441 Test Methods for Measuring the Hiding Power of Powder Coatings
* D6695 Practice for Xenon-Arc Exposures of Paint and Related Coatings
* D7091 Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
*D7803 Standard Practice for Preparation of Zinc (Hot Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating

6 Application Processes

powder application processes



The most common way of applying the powder coating to metal objects is to spray the powder using an electrostatic gun, or corona gun. The gun imparts a negative electric charge to the powder, which is then sprayed towards the grounded object by mechanical or compressed air spraying and then accelerated toward the workpiece by the powerful electrostatic charge. There are a wide variety of spray nozzles available for use in electrostatic coating.

The type of nozzle used will depend on the shape of the workpiece to be painted and the consistency of the paint. The object is then heated, and the powder melts into a uniform film, and is then cooled to form a hard coating. It is also common to heat the metal first and then spray the powder onto the hot substrate. Preheating can help to achieve a more uniform finish but can also create other problems, such as runs caused by excess powder.

Another type of gun is called a tribo gun, which charges the powder by (triboelectric) friction. In this case, the powder picks up a positive charge while rubbing along the wall of a Teflon tube inside the barrel of the gun. These charged powder particles then adhere to the grounded substrate. Using a tribo gun requires a different formulation of powder than the more common corona guns. Tribo guns are not subject to some of the problems associated with corona guns, however, such as back ionization and the Faraday cage effect. Another method of applying powder coating, called the fluidized bed method, is by heating the substrate and then dipping it into an aerated, powder-filled bed. The powder sticks and melts to the hot object. Further heating is usually required to finish curing the coating. This method is generally used when the desired thickness of coating is to exceed 300 micrometres. This is how most dishwasher racks are coated.

pretreatment

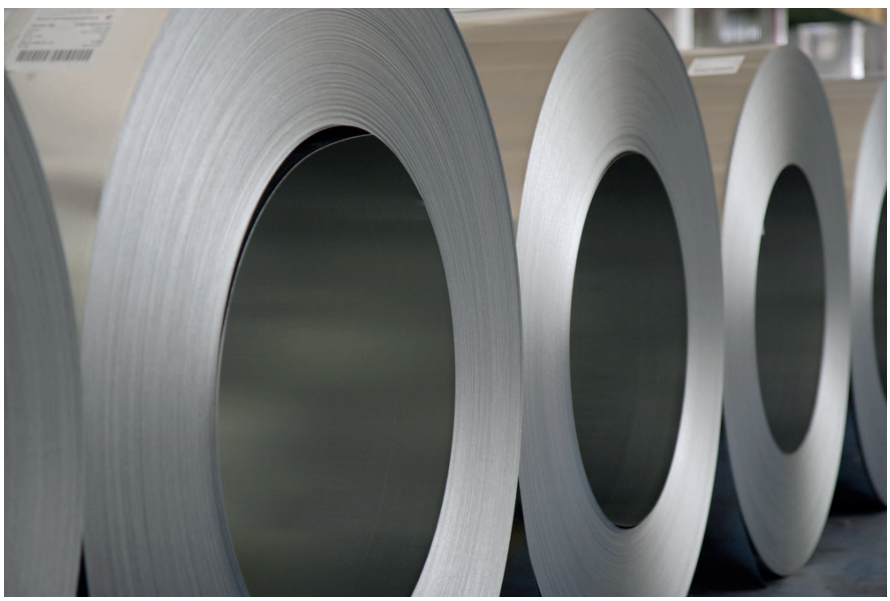
Removal of oil, soil, lubrication greases, metal oxides, welding scales etc. is essential prior to the powder coating process. It can be done by a variety of chemical and mechanical methods. The selection of the method depends on the size and the material of the part to be powder coated, the type of soil to be removed and the performance requirement of the finished product.

The main aims in the preparation of a metal surface prior to powder coating are defined as follows:
- Removal of all foreign matter, eg. Grease, oil, soil, scale, etc.
- Conditioning of the metal surface for the coating that is to be applied.
- Increase the corrosion resistance of the coating metal.

As with other methods of organic coatings attention to the pretreatment stage is essential in order to achieve the full potention of the powder coating. Surface pretreatment may vary depending upon the specific end-use requirements of the finished products; from a single step cleaning operation to a multi stage sophisticated pretreatment which deposits a conversion coating on the surface of the metal. Application of a coating of electrostatically charged particles to an earthed metal surface can only be achieved if the surface is free of any composition which has a high electrical resistance. The presence of any insulating film on the surface of the workpiece to be coated will limit or in some cases prevent powder being deposited.Steel, aluminium, zinc alloys and galvanized steel are common metals on which powder is used. The best performance can be obtained on thoroughly cleaned metal surface.

Steel: For steel surface, maximum corrosion and salt spray resistance are given by a zinc phosphate conversion coating. Medium corrosion and salt spray resistance are given by an iron phosphate conversion coating.

Aluminium: For aluminium and its alloys, although the clean surface is easily coated and adhesion is excellent, performance can be increased using a chromate conversion coating.
Zinc Alloys: With all zinc based substrates such as zintec (It is rolled steel that has been coated with a thin layer of Zinc), Zamac (the alloys are composed Zinc, Aluminium, Magnesium and Copper) and galvanized steel a suitable phosphate coating is recommended. Generally electro-deposited zinc coatings present no pretreatment problems but hot dipped galvanized coating can affect adhesion.



Porous castings and blast cleaned Surface: These surfaces can give considerable difficulty with degassing of the powder coating due to entrapment of air. The profile of the metal and thickness of coating must therefore be strictly controlled. Preheating for a few minutes sometimes overcomes this defect. Element have special formulation to overcome of this problem.

curing

When a thermoset powder is exposed to elevated temperature, it begins to melt, flows out, and then chemically reacts to form a higher molecular weight polymer in a network-like structure. This cure process, called crosslinking, requires a certain temperature for a certain length of time in order to reach full cure and establish the full film properties for which the material was designed. Normally the powders cure at 200°C for 10 minutes. The curing schedule could vary according to the manufacturer's specifications. The application of energy to the product to be cured can be accomplished by convection cure ovens or infrared cure ovens.

Health Safety Environment

health

Powder coating is making every day of people's lives more comfortable and healthier. Health problems when handling or using a powder coating may arise through exposure to hazardous substances, which may be contained in the coatings, or to the powder coating itself. Powder Coatings are classified and labelled in accordance with the EU Dangerous Preparations Directive. Powder Coating manufacturers provide safety data sheets in a standardised form based on the requirements of this Directive. Due account should be taken of information given in the safety data sheet when carrying out the assessments.

safety

It is clear that there is a lower level of hazard when using powder coatings compared to conventional solvent-based paints. Dust clouds in air require 50-100 times the energy necessary to ignite a solvent vapour/air mixture, and are therefore inherently more difficult to ignite. Powder mixtures in air need to be above a certain concentration, known as the lower explosion limit (LEL) before ignition or explosion can occur. Also powder mixtures in air need to be below a certain concentration, known as the upper explosion limit (UEL) before ignition or explosion can occur.

However, certain hazards do exist when using powders depending on various factors. Precautions must be taken to avoid them, and these are referred to here as safe working procedures. If these are followed, any risk should be reduced to a minimum. The main hazards involved in the electrostatic application of powder coatings are:

- Dust explosion and fire
- Electrical shock
- Exposure to hazardous substances
- Compressed air

For detailed information please read "Safe Powder Coating Guideline" written by CEPE.

environment

Powder coatings are renowned for being environmentally responsible. They are 100% solid - this is the paint with no solvents, no fumes, and no dangerous gases, and there are no harmful volatile organic solvents that contribute to greenhouse gas emissions and global warming. Powder coatings have many advantages over alternative finishes. They can be sprayed with much higher efficiency than wet paints, because over-sprayed powder can be collected and re-applied. Which means, as much as 99% of the original product can be used, with minimal waste sent for landfill. Element powder coating products lead the industry in the development of powder coat systems that have minimal impact on the environment.

Element powder coat products:

- Are free of heavy metal pigments such as cadmium, arsenic and mercury. Lead containing pigment are replaced with alternatives.
- Can be stoved and cured at low temperatures and faster times than industry standard offers.
- Are produced with stringent Safety, Health & Environmental policies and standards.
- Are produced and used with minimal waste.

Research and Development

R&D Philosophy

The R&D division is the engine behind Element's efforts to constantly produce innovative and high value-added products to achieve.

The R&D Division is guided by the principles of effective teamwork and respect for the individual. All researchers have free creative rein in their fields of expertise, through which they contribute to the overall strength of the Element organization. Element engages in a truly broad range of research fields, with further work extending into peripheral areas, as well. We have adopted this approach because we believe that excellent products can be created when a backdrop of diversified sciences and technologies exist.

Present-day Research and development is of great importance in powder coating business as the level of competition, production processes and methods are rapidly increasing. It is of special importance in the field of marketing where we keep an eye on our competitors and customers in order to keep pace with new trends and analyze the needs, demands and desires of our customers.

New product design and development is a crucial factor for us. We continually revise our design and range of products. This is necessary due to continuous technology change and development as well as other competitors and the changing preference of customers.

Ideally, powder coatings should be stored in the optimum conditions of less than 30°C and approximately 50 - 60% relative humidity. Under these conditions most powder should be readily usable for at least two year. Avoid placing powder inventory in close proximity to any heat source such as an oven, washer, furnace, space heater, etc

The temperature in the storage room should be about the same as that in the application area.

If the temperature in the storage room and application area is more than 10 °C, the powder coating should store in ambient conditions. About a day before you plan to spray the material, you should move it into the applicaition room and allow it to come to room temparature. Increasingly end users are demanding powder's that cure at temperature below 160 °C. Such powders require careful storage. Low temperature cure powders have no tolerance for warm, moist condiitons, so the storage areas must be kept at a moderate temperature and at low to moderate levels of humidity.

It's important to remember that no matter where powder is stored, if an open box of powder isn't emptied completely, the poly bag in the box should be closed to keep moisture and dirt out of the powder that remains.

Appendix

Appendix

Mesh Size Conversion Table

U.S. MESH	INCHES	MICRONS	MILLIMETERS
10	0.0787	2000	2.000
12	0.0661	1680	1.680
14	0.0555	1410	1.410
16	0.0469	1190	1.190
18	0.0394	1000	1.000
20	0.0331	841	0.841
25	0.0280	707	0.707
30	0.0232	595	0.595
35	0.0197	500	0.500
40	0.0165	400	0.400
45	0.0138	354	0.354
50	0.0117	297	0.297
60	0.0098	250	0.250
70	0.0083	210	0.210
80	0.0070	177	0.177
100	0.0059	149	0.149
120	0.0049	125	0.125
140	0.0041	105	0.105
170	0.0035	88	0.088
200	0.0029	74	0.074
230	0.0024	63	0.063
270	0.0021	53	0.053
325	0.0017	44	0.044
400	0.0015	37	0.037

Appendix

Powder Coating Coverage Chart

A typical powder coatings coverage chart in square meter per kilogram at 100 percent efficiency

Specific Gravity gr/cm3	Film Thickness µm									
	30	40	50	60	70	80	90	100	150	200
1,200	27,78	20,83	16,67	13,89	11,90	10,42	9,26	8,33	5,56	4,17
1,250	26,67	20,00	16,00	13,33	11,43	10,00	8,89	8,00	5,33	4,00
1,300	25,64	19,23	15,38	12,82	10,99	9,62	8,55	7,69	5,13	3,85
1,350	24,69	18,52	14,81	12,35	10,58	9,26	8,23	7,41	4,94	3,70
1,400	23,81	17,86	14,29	11,90	10,20	8,93	7,94	7,14	4,76	3,57
1,450	22,99	17,24	13,79	11,49	9,85	8,62	7,66	6,90	4,60	3,45
1,500	22,22	16,67	13,33	11,11	9,52	8,33	7,41	6,67	4,44	3,33
1,550	21,51	16,13	12,90	10,75	9,22	8,06	7,17	6,45	4,30	3,23
1,600	20,83	15,63	12,50	10,42	8,93	7,81	6,94	6,25	4,17	3,13
1,625	20,51	15,38	12,31	10,26	8,79	7,69	6,84	6,15	4,10	3,08
1,650	20,20	15,15	12,12	10,10	8,66	7,58	6,73	6,06	4,04	3,03
1,675	19,90	14,93	11,94	9,95	8,53	7,46	6,63	5,97	3,98	2,99
1,700	19,61	14,71	11,76	9,80	8,40	7,35	6,54	5,88	3,92	2,94
1,725	19,32	14,49	11,59	9,66	8,28	7,25	6,44	5,80	3,86	2,90
1,750	19,05	14,29	11,43	9,52	8,16	7,14	6,35	5,71	3,81	2,86
1,775	18,78	14,08	11,27	9,39	8,05	7,04	6,26	5,63	3,76	2,82
1,800	18,52	13,89	11,11	9,26	7,94	6,94	6,17	5,56	3,70	2,78
1,825	18,26	13,70	10,96	9,13	7,83	6,85	6,09	5,48	3,65	2,74
1,850	18,02	13,51	10,81	9,01	7,72	6,76	6,01	5,41	3,60	2,70
1,875	17,78	13,33	10,67	8,89	7,62	6,67	5,93	5,33	3,56	2,67
1,900	17,54	13,16	10,53	8,77	7,52	6,58	5,85	5,26	3,51	2,63
1,950	17,09	12,82	10,26	8,55	7,33	6,41	5,70	5,13	3,42	2,56
2,000	16,67	12,50	10,00	8,33	7,14	6,25	5,56	5,00	3,33	2,50

The following formula can be used for figuring coverages other than those given in the chart

(1000 X transfer efficiency) / (specific gravity (gr/cm³) x film thickness (µm)) = Coverage in m²/kg at any transfer efficiency

Transfer efficiency = 1,0 for 100%
Transfer efficiency = 0,9 for 90%

Powder Coating Cost Per Unit Area

- Calculate the cost index by multiplying the price of the powder coating (€/kg) by the specific gravity of the powder coating
- Determine the desired thickness of the cured film (µm)
- Find the cost per unit area (€/m²) at 100 percent efficiency

The following formula can be used to calculate cost per unit area
(Cost index (€/kg) x film thickness (µm)) / (1000 x transfer effiency) = Cost per unit area €/m²
Example: Powder coating with price of 3 €/kg, specific gravity of 1,70 gr/cm³, film thickness of 70 µm and transfer efficiency at 90%.
Cost index = 3 x 1,70 = 5,10
Cost per unit area = (5,10 x 70) / (1000 x 0,9) = 0,39 €/m²

Appendix

ELEMENT ELECTROSTATIC POWDER COATING SERIES

ELM EPX	Epoxy		
Serial no	**Polymer type**	**Curing**	**General description**
ELM EPX 10	Epoxy gloss	180 °C 10'	High chemical resistant epoxy powder coating
ELM EPX 12	Epoxy phenolic	150 °C 10'	Low-curing, high corrosion-resistant epoxy powder coating
ELM EPX 13	Epoxy phenolic	130 °C 10'	Low-curing, high corrosion-resistant epoxy powder coating
ELM EPX 15	Epoxy matt	200 °C 10'	Decorative matt epoxy powder coating

ELM HYB	Epoxy polyester (Hybrid)		
Serial no	**Polymer type**	**Curing**	**General discription**
ELM HYB 20	Epoxy polyester matt	200 °C 10'	Semi-matt and matt epoxy- polyester powder coating for general use
ELM HYB 22	Epoxy polyester	200 °C 10'	Very good surface epoxy-polyester powder coating
ELM HYB 24	Epoxy polyester	140 °C 10'	Very low curing epoxy-polyester powder coating
ELM HYB 25	Epoxy polyester matt	200 °C 10'	Yellowing-resistant, semi-matt and matt epoxy-poyester powder coating
ELM HYB 26	Epoxy polyester	160 °C 10'	Low-curing epoxy-polyester powder coating
ELM HYB 28	Epoxy polyester	180 °C 10'	Epoxy-polyester powder coating for general use

ELM PLA	Polyester architectural		
Serial no	**Polymer type**	**Curing**	**General description**
ELM PLA 30	Polyester HAA	180 °C 10'	Polyester powder coating (tgic free) with a very good surface for the architectural application
ELM PLA 35	Poliester HAA matt	200 °C 10'	Polyester matt powder coating(tgic free) for general use
ELM PLA 40	Polyester TGIC	200 °C 10'	Very good surface, Qualicoat approved polyester architectural powder coating with TGIC
ELM PLA 45	Polyester TGIC matt	200 °C 10'	Matt polyester powder coating with TGIC for general use

ELM PLI	Polyester industrial		
Serial no	**Polymer type**	**Curing**	**General discription**
ELM PLI 37	Polyester HAA	180 °C 10'	Polyester powder coating(tgic free) for general use
ELM PLI 38	Polyester HAA	160 °C 10'	Low-curing Polyester powder coating (tgic free) for **general use**
ELM PLI 47	Polyester TGIC	200 °C 10'	Polyester powder coating with TGIC for general use
ELM PLI 48	Polyester TGIC	180 °C 10'	Polyester 180 C powder coating with TGIC for general use

ELM PUR	Polyurethane		
Serial no	**Polymer type**	**Curing**	**General discription**
ELM PUR 60	Polyurethane	200 °C 15'	Crocodile patterned polyurethane powder coating

Appendix

Permitted colour tolerances of solid colour powder coatings for architectural applications

RAL colour card	max ?E P>65°	max ?Lab	max ?E P<65°	max ?Lab	RAL colour card	max ?E P>65°	max ?Lab	max ?E P<65°	max ?Lab	RAL colour card	max ?E P>65°	max ?Lab	max ?E P<65°	max ?Lab
1000	2,0	1,2	2,6	1,5	4007	1,4	0,8	1,8	1,1	7004	1,0	0,6	1,3	0,8
1001	2,0	1,2	2,6	1,5	4008	1,4	0,8	1,8	1,1	7005	1,4	0,8	1,8	1,1
1002	2,0	1,2	2,6	1,5	4009	1,0	0,6	1,3	0,8	7006	1,4	0,8	1,8	1,1
1003*	3,6	2,1	4,7	2,7	4010*	2,0	1,2	2,6	1,5	7008	2,0	1,2	2,6	1,5
1004*	3,6	2,1	4,7	2,7	**5000**	2,0	1,2	2,6	1,5	7009	1,4	0,8	1,8	1,1
1005	3,6	2,1	4,7	2,7	5001	2,0	1,2	2,6	1,5	7010	1,4	0,8	1,8	1,1
1006	3,6	2,1	4,7	2,7	5002*	2,0	1,2	2,6	1,5	7011	1,4	0,8	1,8	1,1
1007	3,6	2,1	4,7	2,7	5003	2,0	1,2	2,6	1,5	7012	1,4	0,8	1,8	1,1
1011	2,0	1,2	2,6	1,5	5004	2,0	1,2	2,6	1,5	7013	1,4	0,8	1,8	1,1
1012	2,8	1,6	3,6	2,1	5005	2,0	1,2	2,6	1,5	7015	1,4	0,8	1,8	1,1
1013	0,8	0,5	1,0	0,6	5007	2,0	1,2	2,6	1,5	7016	2,0	1,2	2,6	1,5
1014	2,0	1,2	2,6	1,5	5008	2,0	1,2	2,6	1,5	7021	1,4	0,8	1,8	1,1
1015	0,8	0,5	1,0	0,6	5009	2,0	1,2	2,6	1,5	7022	1,4	0,8	1,8	1,1
1016*	2,8	1,6	3,6	2,1	5010	2,0	1,2	2,6	1,5	7023	1,4	0,8	1,8	1,1
1017	2,8	1,6	3,6	2,1	5011	2,0	1,2	2,6	1,5	7024	1,4	0,8	1,8	1,1
1018*	2,8	1,6	3,6	2,1	5012	2,0	1,2	2,6	1,5	7026	2,0	1,2	2,6	1,5
1019	1,0	0,6	1,3	0,8	5013	2,0	1,2	2,6	1,5	7030	1,0	0,6	1,3	0,8
1020	2,0	1,2	2,6	1,5	5014	2,0	1,2	2,6	1,5	7031	2,0	1,2	2,6	1,5
1021*	3,6	2,1	4,7	2,7	5015	2,0	1,2	2,6	1,5	7032	1,0	0,6	1,3	0,8
1023*	3,6	2,1	4,7	2,7	5017	2,0	1,2	2,6	1,5	7033	1,4	0,8	1,8	1,1
1024	2,0	1,2	2,6	1,5	5018	2,0	1,2	2,6	1,5	7034	1,4	0,8	1,8	1,1
1027	2,8	1,6	3,6	2,1	5019	2,0	1,2	2,6	1,5	7035	1,0	0,6	1,3	0,8
1028*	3,6	2,1	4,7	2,7	5020	2,0	1,2	2,6	1,5	7036	1,0	0,6	1,3	0,8
1032	3,6	2,1	4,7	2,7	5021	2,0	1,2	2,6	1,5	7037	1,4	0,8	1,8	1,1
1033	3,6	2,1	4,7	2,7	5022	2,0	1,2	2,6	1,5	7038	1,0	0,6	1,3	0,8
1034	2,8	1,6	3,6	2,1	5023	2,0	1,2	2,6	1,5	7039	1,4	0,8	1,8	1,1
1037	3,6	2,1	4,7	2,7	5024	2,0	1,2	2,6	1,5	7040	1,0	0,6	1,3	0,8
2000	3,6	2,1	4,7	2,7	**6000**	2,0	1,2	2,6	1,5	7042	1,0	0,6	1,3	0,8
2001	2,8	1,6	3,6	2,1	6001	2,8	1,6	3,6	2,1	7043	1,4	0,8	1,8	1,1
2002*	2,8	1,6	3,6	2,1	6002	2,8	1,6	3,6	2,1	7044	1,0	0,6	1,3	0,8
2003	2,8	1,6	3,6	2,1	6003	2,0	1,2	2,6	1,5	7045	1,0	0,6	1,3	0,8
2004*	3,6	2,1	4,7	2,7	6004	2,0	1,2	2,6	1,5	7046	1,4	0,8	1,8	1,1
2008	3,6	2,1	4,7	2,7	6005	2,0	1,2	2,6	1,5	7047	1,0	0,6	1,3	0,8
2009*	3,6	2,1	4,7	2,7	6006	1,4	0,8	1,8	1,1	**8000**	2,0	1,2	2,6	1,5
2010	2,8	1,6	3,6	2,1	6007	1,4	0,8	1,8	1,1	8001	2,0	1,2	2,6	1,5
2011	3,6	2,1	4,7	2,7	6008	1,4	0,8	1,8	1,1	8002	2,0	1,2	2,6	1,5
2012	2,8	1,6	3,6	2,1	6009	1,4	0,8	1,8	1,1	8003	2,0	1,2	2,6	1,5
3000	2,8	1,6	3,6	2,1	6010	2,8	1,6	3,6	2,1	8004	2,0	1,2	2,6	1,5
3001	2,8	1,6	3,6	2,1	6011	2,0	1,2	2,6	1,5	8007	2,0	1,2	2,6	1,5
3002	2,8	1,6	3,6	2,1	6012	1,4	0,8	1,8	1,1	8008	2,0	1,2	2,6	1,5
3003*	2,8	1,6	3,6	2,1	6013	2,0	1,2	2,6	1,5	8011	2,0	1,2	2,6	1,5
3004	2,0	1,2	2,6	1,5	6014	1,4	0,8	1,8	1,1	8012	2,0	1,2	2,6	1,5
3005	2,0	1,2	2,6	1,5	6015	1,4	0,8	1,8	1,1	8014	1,4	0,8	1,8	1,1
3007	1,4	0,8	1,8	1,1	6016	2,0	1,2	2,6	1,5	8015	2,0	1,2	2,6	1,5
3009	2,0	1,2	2,6	1,5	6017	2,8	1,6	3,6	2,1	8016	1,4	0,8	1,8	1,1
3011	2,8	1,6	3,6	2,1	6018*	2,8	1,6	3,6	2,1	8017	1,4	0,8	1,8	1,1
3012	2,0	1,2	2,6	1,5	6019	1,0	0,6	1,3	0,8	8019	1,4	0,8	1,8	1,1
3013	2,8	1,6	3,6	2,1	6020	1,4	0,8	1,8	1,1	8022	1,4	0,8	1,8	1,1
3014	2,0	1,2	2,6	1,5	6021	2,0	1,2	2,6	1,5	8023	2,8	1,6	3,6	2,1
3015	1,0	0,6	1,3	0,8	6022	1,4	0,8	1,8	1,1	8024	2,8	1,6	3,6	2,1
3016	2,8	1,6	3,6	2,1	6024	2,8	1,6	3,6	2,1	8025	1,4	0,8	1,8	1,1
3017	2,8	1,6	3,6	2,1	6025	2,8	1,6	3,6	2,1	8028	1,4	0,8	1,8	1,1
3018	2,8	1,6	3,6	2,1	6026	2,0	1,2	2,6	1,5	**9001**	0,8	0,5	1,0	0,6
3020*	2,8	1,6	3,6	2,1	6027	2,0	1,2	2,6	1,5	9002	0,8	0,5	1,0	0,6
3022	2,8	1,6	3,6	2,1	6028	2,0	1,2	2,6	1,5	9003	0,8	0,5	1,0	0,6
3027	2,8	1,6	3,6	2,1	6029	2,0	1,2	2,6	1,5	9004	1,4	0,8	1,8	1,1
3031	2,8	1,6	3,6	2,1	6032	2,8	1,6	3,6	2,1	9005	1,4	0,8	1,8	1,1
4001	1,4	0,8	1,8	1,1	6033	2,0	1,2	2,6	1,5	9010	0,8	0,5	1,0	0,6
4002	2,0	1,2	2,6	1,5	6034	2,0	1,2	2,6	1,5	9011	1,4	0,8	1,8	1,1
4003*	1,4	0,8	1,8	1,1	**7000**	2,0	1,2	2,6	1,5	9016	0,8	0,5	1,0	0,6
4004*	2,0	1,2	2,6	1,5	7001	2,0	1,2	2,6	1,5	9017	1,4	0,8	1,8	1,1
4005	2,0	1,2	2,6	1,5	7002	1,4	0,8	1,8	1,1	9018	1,0	0,6	1,3	0,8
4006	1,4	0,8	1,8	1,1	7003	1,4	0,8	1,8	1,1					

Source:
Permitted colour tolerances of solid colour powder coatings for architectural applications Issued by the German Paint Industry Association