

POWDER COATING OF FLAT GLASS

Organic based powder coating of flat glass is a modern and especially environmental friendly new industrial coating technique. This technology solves the inherent problem of adhesion on glass and is now ready to be commercially exploited for interior application fields e.g. furniture, kitchens, bath-rooms, wall partitions, displays, shop-fittings. Out-door applications for facades are in the development stage.

Application

Depending on the line design and size, principally all flat glass sheets with a width ranging usually from 60 to 225 cm and up to a length of 4 m in glass thicknesses from 4 to 19 mm can be powder coated. This process also allows the powder coating of tempered safety glass subsequent to the tempering stage. All glass sheets can be powder coated either in single cut custom made pieces or in large format to be customized subsequently.

Under TIGER development is the powder coating of laminated safety glass for interior or exterior use. For such applications the powder is applied on face 3 hence well protected from the UV radiation of the sun by the combination of glass and lamination foil.

Multi-Stage Process

Powder coating plants for flat glass usually operate horizontally; the flat glass sheets are transported by a heat resistant conveyor system. This new powder coating technique of flat glass comprises a multi-stage process including

- Cleaning & Washing
- Deposition of an uniform SiO_x layer by using TIGER Pre-Treatment Series 515
- Application of TIGER Adhesion Promoter of Series 518
- Application of TIGER Drylac® Glass powder coating

Series 580

- IR Curing of the powder coating
- Cooling off zone
- Handling & Packaging

Cleaning and washing of the flat glass is accomplished by commercially available equipment. After the final washing step no dust, grease, or residuals of cleaning agents or surfactants should remain on the glass in order to achieve good adhesion of the powder coating. Special attention should be given to the final rinsing step using deionized water with a conductivity of $< 15 \mu\text{S}$ only.

The silicon oxide layer provides an extremely thin (nanometer range) and uniform film of SiO_x on the surface of the glass. It is applied by an oscillating flame spray aggregate using the formulated organic silicon compound TIGER Drylac® Pre-Treatment Series 515.

The IPA containing adhesion promoter is applied by an oscillating spray-equipment providing an extremely thin film (nanometer range) for enhancing the adhesion of the powder coating TIGER Drylac® Glass Series 580 on the SiO_x pre-treated glass.

The application of the powder coating is conducted by oscillating electrostatic Corona powder guns with electronic control. The powder application should be performed using automatic guns and substrate scanning systems. The applied coating thickness is usually 80 to 100 μm and should be controlled within small tolerances. Powder should be applied on the "fire side" of the glass and not on the tin side.

TIGER Drylac® Glass Series 580 is a highly reactive epoxy/polyester hybrid type powder coating system for interior applications only. The curing - chemical cross-linking - of the applied powder usually takes place in electrical IR oven systems. Depending on process and oven design different curing times may be reached. Usual surface temperatures of the glass are

135 °C at 5 minutes or 150 °C at 3 minutes. The high reactivity of this TIGER powder coating leads to reduced curing times and cooling off periods and therefore high productivity and minimum space requirements. After curing and cooling off to around 40°C the finished powder coated glass can be stacked and packaged. An appropriate quality assurance system should be implemented.

Coating & Layer System

The entire multi-layer and coating system consists of:

- Cleaned and washed flat glass - 4 to 19 mm of thickness
- Thin layer silicon oxide provided by TIGER Pre-Treatment Series 515
- Thin layer adhesion promoter of TIGER Adhesion Promotor Series 518
- Powder coating TIGER Drylac® Glass Series 580

Features

With properly manufactured powder coated glass according to this proposed multi-stage process, excellent properties of the finishing as listed in the *Table # 1* can be achieved. This data apply for interior applications; TIGER development work for exterior applications is in progress.

Powder coatings of flat glass deliver outstanding mechanical properties e.g. abrasion and scratch resistance due to the high film thickness and its thermosetting characteristics. Good adhesion is assured also under humid conditions.

Test	Standard	Requirements	Results
Condenswater Resistance	EN1096-2 (Appendix B)	Class A (21 days or 504 h)	passed
Acid Resistance	EN1096-2 (Appendix C)	Classe A (5 Cycles)	passed
Resistance to Neutral Salt Spray	EN1096-2 (Appendix D)	Class A (21 days or 504 h)	passed
Abrasion Resistances	EN1096-2 (Appendix E)	Class A (500 Cycles)	passed
Chemical Resistance	DIN 68861-1	1B	passed

Table # 1: Properties of Powder Coated Glass

TIGER Drylac® Glass Series 580 powder coatings are available in a selected color range as stock items; other colors according to RAL, NCS color standards or custom colors are

available too. The finishing is available in Microtexture and Smooth Design (smooth matte) surfaces. Unique sparkling effects can be achieved by 2-coat powder systems. Other special effects can be obtained using white and/or satinato treated glass. In contrast to liquid coating powder coating lines allow fast color changes. Color charts are available upon request.

Above all, this coating process does not cause any VOC (Volatile Organic Compounds) emissions as it is the case with solvent containing paints.

Investment

The investment for multi-stage powder coating plants vary from 0,6 to 1.5 Mio € largely depending on size/capacity – in particular on the width and conveyor speed – and the type and supplier of the required equipment units.

TIGER is in a position to technically guide potential investors on line design and basic engineering, manufactures and suppliers of equipment. However, TIGER is not acting as a General Contractor. For potential investors TIGER can arrange for demonstrations at our customers for complete powder coatings lines

- a) smaller size plant without pre-treatment stages – refer to www.adifos.com and
- b) large size plant with a line width of 225 cm – refer to www.glaswest.com

Digital Inkjet Printing & Powder Coating

A very new and innovative market opportunity is to integrate a flat glass powder coating line together with a digital inkjet printing operation. In this case, the powder coating protects the inkjet printing images; in addition the use of white or other solid colored powder coatings as a top coat make the inkjet printed images more vivid and serve as background color.

For demonstration of such an integrated manufacturing plant of inkjet printing and powder coating TIGER can arrange for a demonstration at our Italian customer – refer to www.adifos.com

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