

POWDER COATING FOR FLAT GLASS

Organic-based powder coating for flat glass is a modern and especially environmentally friendly new industrial coating technique. This technology solves the inherent problem of adhesion on glass and is commercially exploited for interior applications such as; furniture, kitchen tops, bathroom tops and partitions, wall partitions, displays and shop fittings. Outdoor applications for façades are in the development stage.

Application

Depending on the application line size and design, in principle, all flat glass sheets with a width ranging from 23-89 inches (60-225 cm) and a length of up to 13 ft (4 m) in glass thicknesses from 0.15-0.74 inches (4-19 mm) can be powder coated. This powder coating process is also suitable for tempered safety glass in which case the powder coating is performed 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 afterward. TIGER is undergoing the development of powder coating for laminated safety glass for interior and exterior use. For such applications the powder coating is applied in phase 3 of the process, which means it is well protected from UV radiation by the combination of glass and lamination foil.

Coating and multi-layered system

The multi-layered and coating system consists of:

- cleaned and washed flat glass with a thickness of 0.15-0.74 inches (4-9 mm)
- thin silicon oxide layer provided by TIGER Pre-Treatment Series 515
- thin layer of TIGER Adhesion Promoter Series 518
- powder coating TIGER Drylac® Glass Series 580

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:

1. Cleaning and washing

Cleaning and washing the flat glass is accomplished by commercially available equipment. To achieve a good adhesion, no dust, grease or residuals of cleaning agents or surfactants should remain on the glass after the final washing step. Special attention should be given to the final washing step using deionized water with a conductivity of <15 mS only.

2. Deposition of a silicon oxide (SiOx) uniform layer of TIGER Pre-treatment Series 515

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

3. Application of TIGER Adhesion Promoter Series 518

The isopropyl alcohol (IPA) containing adhesion promoter is applied by an oscillating spray equipment providing an extremely thin film (nanometer range). This enhances the adhesion of the powder coating TIGER Drylac® Glass Series 580 onto the pre-treated glass with SiOx.

4. Application of TIGER Drylac® Glass Series 580

The application of the powder coating is conducted by oscillating electrostatic Corona powder guns with electronic control. The powder coating application should be performed using automatic guns and substrate scanning systems. The applied powder coating thickness is usually 3.14-3.93 mils (80-100 µm) and should be controlled within small tolerances. The powder coating should be applied on the 'fire side' of the glass and not on the tin side.

5. IR curing of the powder coating

TIGER Drylac® Series 580 is a highly reactive epoxy-polyester hybrid powder coating system for interior applications only. The curing (chemical cross linking) of the applied powder layer usually takes place in electrical IR oven systems. Depending on the process and oven design, different curing times may be reached. Usual surface temperatures of the glass should cure at 275 °F (135 °C) at 5 minutes or 302 °F (150 °C) at 3 minutes. The high reactivity of the powder coating leads to reduced curing times and cooling off periods leading to high productivity and minimum space requirements.

6. Cooling off zone

After curing, cooling off should be around 104 °F (40 °C).

7. Handling and packaging

The finished powder coated glass can be stacked and packaged. An appropriate quality assurance system should be implemented.

Features

With properly manufactured powder coated glass according to this proposed multi-stage process, excellent properties of the finishing, as listed in Table 1 below, can be achieved. This data applies for interior applications. Due to its high film thickness and its thermosetting characteristics, powder coating for flat glass delivers outstanding mechanical properties such as abrasion and scratch resistance. Good adhesion is also assured under humid conditions.

standard	test	requirements	results
EN 1096-2 (appendix B)	condensed water resistance	class A (21 days or 504 hours)	passed
EN 1096-2 (appendix C)	acid resistance	class A (5 cycles)	passed
EN 1096-2 (appendix D)	resistance to neutral salt spray	class A (21 days or 504 hours)	passed
EN 1096-2 (appendix E)	abrasion resistance	class A (500 cycles)	passed
DIN 68861-1	chemical resistance	1B	passed

Table 1 - properties of powder coated glass

TIGER Drylac® Glass powder coating Series 580 can be custom-made to order in RAL, NCS or other colour standards. Series 580 is available in Microtexture and Smooth Design (smooth matte) finishes. Special sparkling effects can be achieved by two-coat powder coating systems. Other special effects can be obtained using white and/or satinato treated glass. In contrast to liquid coating, powder coating lines allow fast colour changes. Colour charts are available upon request.

This coating process does not produce VOCs (Volatile Organic Compounds) emissions as it is the case with solvent-containing paints.

Investment

The investment for multi-stage powder coating plants can range between USD 0.8-2.1 million, largely depending on size and capacity – in particular on the width, 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 equipment manufacturers and suppliers. However, TIGER is not acting as a general contractor. For potential investors TIGER can arrange for demonstrations at customers' sites for complete powder coating lines.

- for small size plants with no pre-treatment stages, refer to www.adifos.com.
- for large size plants with a line width of 88 inches (225 cm), refer to www.glaswest.com.

Digital inkjet printing and powder coating

A new and innovative process 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 printed graphics. In addition, the use of white or other opaque coloured powder coating as a base coat make the inkjet printed graphics more vivid and serve as background colour.

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

Certified according to
ISO 9001 | 14001

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